BS EN 754-2:2016

BSI Standards Publication

Aluminium and aluminium alloys — Cold drawn rod/bar and tube

Part 2: Mechanical properties

bsi.

National foreword

This British Standard is the UK implementation of EN 754-2:2016. It supersedes BS EN 754-2:2013 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee NFE/35, Light metals and their alloys.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2016

ISBN 978 0 580 93158 1

ICS 77.150.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2016.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 754-2

November 2016

ICS 77.150.10

Supersedes EN 754-2:2013

English Version

Aluminium and aluminium alloys - Cold drawn rod/bar and tube - Part 2: Mechanical properties

Aluminium et alliages d'aluminium - Barres et tubes étirés - Partie 2: Caractéristiques mécaniques

Aluminium und Aluminiumlegierungen - Gezogene Stangen und Rohre - Teil 2: Mechanische Eigenschaften

This European Standard was approved by CEN on 15 August 2016.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 754-2:2016 E

Contents

Page

European foreword ... **3**

1 Scope ... **4**

2 Normative references ... **4**

3 Mechanical property limits ... **4**
3.1 General ... **4**
3.2 Elongation ... **4**
3.3 Reference list of the tables of mechanical properties of the relevant aluminium and aluminium alloys ... **5**
3.4 Detailed tables of mechanical properties ... **6**

Annex A (informative) **List of tempers used in Tables 1 to 37** ... **37**

Bibliography ... **39**

European foreword

This document (EN 754-2:2016) has been prepared by Technical Committee CEN/TC 132 “Aluminium and aluminium alloys”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2017, and conflicting national standards shall be withdrawn at the latest by May 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 754-2:2013.

CEN/TC 132 affirms its policy that if a patentee refuses to grant licenses on standardized products under reasonable and not discriminatory conditions, this product will be removed from the corresponding document.

EN 754 comprises the following parts under the general title *"Aluminium and aluminium alloys — Cold drawn rod/bar and tube*":

— *Part 1: Technical conditions for inspection and delivery*

— *Part 2: Mechanical properties*

— *Part 3: Round bars, tolerances on dimensions and form*

— *Part 4: Square bars, tolerances on dimensions and form*

— *Part 5: Rectangular bars, tolerances on dimensions and form*

— *Part 6: Hexagonal bars, tolerances on dimensions and form*

— *Part 7: Seamless tubes, tolerances on dimensions and form*

— *Part 8: Porthole tubes, tolerances on dimensions and form*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the mechanical property limits resulting from tensile testing applicable to aluminium and aluminium alloy cold drawn rod/bar and tube.

Technical conditions for inspection and delivery, including product and testing requirements, are specified in EN 754-1. Temper designations are defined in EN 515. The chemical composition limits for these materials are given in EN 573-3.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 754-1:2016, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 1: Technical conditions for inspection and delivery*

EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1)*

3 Mechanical property limits

3.1 General

The mechanical properties shall be in conformity with those specified in Table 1 to Table 37 or those agreed upon between supplier and purchaser and stated in the order document.

For all alloys the condition F (as fabricated) can be used, but without guaranteed mechanical properties.

Table 1 to Table 37 contain limits of mechanical property values obtained by tensile testing according to EN ISO 6892-1 after sampling and test piece preparation according to EN 754-1.

NOTE The mechanical properties refer to test pieces taken in the longitudinal direction. Mechanical properties of test pieces taken in other directions can differ from those for the longitudinal direction quoted in this standard.

Brinell hardness values given in Table 1 to Table 37 expressed as HBW values are for information only.

3.2 Elongation

If not otherwise agreed, the *A* value shall be used.

The *A* value for elongation is the % elongation measured over a gauge length of $5,65\sqrt{S_0}$ (where S_0 is the initial cross-sectional area of the test-piece), and expressed in percent.

For certain products the supplier may choose (if not otherwise specified in the order documents) to use the elongation based on A_{50mm}. Consequently, values for the A_{50mm} are included in the following tables.

The A_{50mm} value is the elongation measured over a gauge length of 50 mm and expressed in percent.

Test pieces and their location in the specimen are given in EN 754-1.

3.3 Reference list of the tables of mechanical properties of the relevant aluminium and aluminium alloys

			Page
Table 1 :	Aluminium EN AW-1050A	[Al 99,5]	6
Table 2 :	Aluminium EN AW-1200	[AI 99,0]	7
Table 3 :	Alloy EN AW-2007	[Al Cu4PbMgMn]	8
Table 4 :	Alloy EN AW-2011	[AI Cu6BiPb]	9
Table 5 :	Alloy EN AW-2011A	[AI Cu6BiPb(A)]	10
Table 6 :	Alloy EN AW-2014	[AI Cu4SiMg]	11
Table 7 :	Alloy EN AW-2014A	[AI Cu4SiMg(A)]	12
Table 8 :	Alloy EN AW-2017A	[AI Cu4MgSi(A)]	13
Table 9 :	Alloy EN AW-2024	[AI Cu4Mg1]	14
Table 10 :	Alloy EN AW-2030	[AI Cu4PbMg]	15
Table 11 :	Alloy EN AW-3003	[AI Mn1Cu]	16
Table 12 :	Alloy EN AW-3103	[AI Mn1]	17
Table 13 :	Alloy EN AW-5005	[AI Mg1(B)]	18
Table 14 :	Alloy EN AW-5005A	[AI Mg1(C)]	18
Table 15 :	Alloy EN AW-5019	[AI Mg5]	19
Table 16 :	Alloy EN AW-5049	[Al Mg2Mn0,8]	20
Table 17 :	Alloy EN AW-5251	[AI Mg2Mn0,3]	21
Table 18 :	Alloy EN AW-5052	[AI Mg2,5]	22
Table 19 :	Alloy EN AW-5154A	[AI Mg3,5(A)]	23
Table 20 :	Alloy EN AW-5754	[AI Mg3]	24
Table 21 :	Alloy EN AW-5083	[AI Mg4,5Mn0,7]	25
Table 22 :	Alloy EN AW-5086	[AI Mg4]	26
Table 23 :	Alloy EN AW-6012	[AI MgSiPb]	27
Table 24 :	Alloy EN AW-6026	[AI MgSiBi]	27
Table 25 :	Alloy EN AW-6060	[AI MgSi]	28
Table 26 :	Alloy EN AW-6061	[AI Mg1SiCu]	29
Table 27 :	Alloy EN AW-6262	[AI Mg1SiPb]	30
Table 28 :	Alloy EN AW-6262A	[AI Mg1SiSn]	30
Table 29 :	Alloy EN AW-6063	[AI Mg0,7Si]	31
Table 30 :	Alloy EN AW-6063A	[AI Mg0,7Si(A)]	32
Table 31 :	Alloy EN AW-6064A	[AI Mg1SiBi]	33
Table 32 :	Alloy EN AW-6065	[AI Mg1Bi1Si]	33
Table 33 :	Alloy EN AW-6082	[AI Si1MgMn]	34

Table 34 : Alloy EN AW-7020 [Al Zn4,5Mg1] 34
Table 35 : Alloy EN AW-7022 [Al Zn5Mg3Cu] 35
Table 36 : Alloy EN AW-7049A [Al Zn8MgCu] 35
Table 37 : Alloy EN AW-7075 [Al Zn5,5MgCu] 36

3.4 Detailed tables of mechanical properties

Table 1 — Aluminium EN AW-1050A [Al 99,5]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	60	95	-	-	25	22	20
H14	≤ 40	≤ 10	100	135	70	-	6	5	30
H16	≤ 15	≤ 5	120	160	105	-	4	3	35
H18	≤ 10	≤ 3	145	-	125	-	3	3	43
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		60	95	-	-	25	22	20
H14	≤ 10		100	135	70	-	6	5	30
H16	≤ 5		120	160	105	-	4	3	35
H18	≤ 3		145	-	125	-	3	3	43

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 2 — Aluminium EN AW-1200 [Al 99,0]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	70	105	-	-	20	16	23
H14	≤ 40	≤ 10	110	145	80	-	5	4	37
H16	≤ 15	≤ 5	135	170	115	-	3	3	45
H18	≤ 10	≤ 3	150	-	130	-	3	3	50
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		70	105	-	-	20	16	23
H14	≤ 10		110	145	80	-	5	4	37
H16	≤ 5		135	170	115	-	3	3	45
H18	≤ 3		150	-	130	-	3	3	50

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 3 — Alloy EN AW-2007 [Al Cu4PbMgMn]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
T3 [c]	≤ 30	≤ 30	370	-	240	-	7	5	95
	30 < D ≤ 80	30 < S ≤ 80	340		220		6	-	95
T351 [c]	≤ 80	≤ 80	370	-	240	-	5	3	95
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
T3 [c]	≤ 20		370	-	250	-	7	5	95
T3510 T3511 [c]	≤ 20		370	-	240	-	5	3	95

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by press quenching.

Table 4 — Alloy EN AW-2011 [Al Cu6BiPb]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
T3	≤ 40	≤ 40	320	-	270	-	10	8	90
	40 < D ≤ 50	40 < S ≤ 50	300	-	250	-	10	-	90
	50 < D ≤ 80	50 < S ≤ 80	280	-	210	-	10	-	90
T8	≤ 80	≤ 80	370	-	270	-	8	6	115
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
T3 c	≤ 5		310	-	260	-	10	8	90
	5 < t ≤ 20		290	-	240	-	8	6	90
T8	≤ 20		370	-	275	-	8	6	115

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

c Properties may be obtained by press quenching.

Table 5 — Alloy EN AW-2011A [Al Cu6BiPb(A)]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
T3	≤ 40	≤ 40	320	-	270	-	10	8	90
	40 < D ≤ 50	40 < S ≤ 50	300	-	250	-	10	-	90
	50 < D ≤ 80	50 < S ≤ 80	280	-	210	-	10	-	90
T8	≤ 80	≤ 80	370	-	270	-	8	6	115
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
T3 [c]	≤ 5		310	-	260	-	10	8	90
	5 < t ≤ 20		290	-	240	-	8	6	90
T8	≤ 20		370	-	275	-	8	6	115

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by press quenching.

Table 6 — Alloy EN AW-2014 [Al Cu4SiMg]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 80	-	240	-	125	12	10	45
T3	≤ 80	≤ 80	380	-	290	-	8	6	110
T351	≤ 80	≤ 80	380	-	290	-	6	4	110
T4	≤ 80	≤ 80	380	-	220	-	12	10	110
T451	≤ 80	≤ 80	380	-	220	-	10	8	110
T6	≤ 80	≤ 80	450	-	380	-	8	6	140
T651	≤ 80	≤ 80	450	-	380	-	6	4	140
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		-	240	-	125	12	10	45
T3	≤ 20		380	-	290	-	8	6	110
T3510, T3511	≤ 20		380	-	290	-	6	4	110
T4	≤ 20		380	-	240	-	12	10	110
T4510, T4511	≤ 20		380	-	240	-	10	8	110
T6	≤ 20		450	-	380	-	8	6	140
T6510, T6511	≤ 20		450	-	380	-	6	4	140

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 7 — Alloy EN AW-2014A [Al Cu4SiMg(A)]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 80	-	240	-	125	12	10	45
T3	≤ 80	≤ 80	380	-	290	-	8	6	110
T351	≤ 80	≤ 80	380	-	290	-	6	4	110
T4	≤ 80	≤ 80	380	-	220	-	12	10	110
T451	≤ 80	≤ 80	380	-	220	-	10	8	110
T6	≤ 80	≤ 80	450	-	380	-	8	6	140
T651	≤ 80	≤ 80	450	-	380	-	6	4	140
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		-	240	-	125	12	10	45
T3	≤ 20		380	-	290	-	8	6	110
T3510, T3511	≤ 20		380	-	290	-	6	4	110
T4	≤ 20		380	-	240	-	12	10	110
T4510, T4511	≤ 20		380	-	240	-	10	8	110
T6	≤ 20		450	-	380	-	8	6	140
T6510, T6511	≤ 20		450	-	380	-	6	4	140

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 8 — Alloy EN AW-2017A [Al Cu4MgSi(A)]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 80	-	240	-	125	12	10	45
T3 [c]	≤ 80	≤ 80	400	-	250	-	10	8	105
T351 [c]	≤ 80	≤ 80	400	-	250	-	8	6	105
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		-	240	-	125	12	10	45
T3 [c]	≤ 20		400	-	250	-	10	8	105
T3510, T3511 [c]	≤ 20		400	-	250	-	8	6	105

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by press quenching.

Table 9 — Alloy EN AW-2024 [AlCu4Mg1]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 80	-	250	-	150	12	10	47
T3	≤ 10	≤ 10	425	-	310	-	10	8	120
	10 < D ≤ 80	10 < S ≤ 80	425		290		9	7	120
T351	≤ 80	≤ 80	425	-	310	-	8	6	120
T6	≤ 80	≤ 80	425	-	315	-	5	4	125
T651	≤ 80	≤ 80	425	-	315	-	4	3	125
T8	≤ 80	≤ 80	455	-	400	-	4	3	130
T851	≤ 80	≤ 80	455	-	400	-	3	2	130
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		-	240	-	140	12	10	47
T3	≤ 5		440	-	290	-	10	8	120
	5 < t ≤ 20		420		270		10	8	120
T3510, T3511	≤ 20		420	-	290	-	8	6	120

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 10 — Alloy EN AW-2030 [Al Cu4PbMg]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
T3 c	≤ 30	≤ 30	370	-	240	-	7	5	115
	30 < D ≤ 80	30 < S ≤ 80	340		220		6	-	115
T351 c	≤ 80	≤ 80	370	-	240	-	5	3	115
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
T3 c	≤ 20		370	-	240	-	7	5	115
T3510, T3511 c	≤ 20		370	-	240	-	5	3	115

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

c Properties may be obtained by press quenching.

Table 11 — Alloy EN AW-3003 [Al Mn1Cu]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	95	130	35	-	25	20	29
H14	≤ 40	≤ 10	130	165	110	-	6	4	40
H16	≤ 15	≤ 5	160	195	130	-	4	3	47
H18	≤ 10	≤ 3	180	-	145	-	3	2	55
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		95	130	35	-	25	20	29
H11	≤ 17		105	140	55	-	20	16	32
H12	≤ 15		115	150	75	-	14	12	35
H13	≤ 12		125	160	95	-	11	8	38
H14	≤ 10		130	165	110	-	6	4	40
H15	≤ 7		145	180	120	-	5	4	44
H16	≤ 5		160	195	130	-	4	3	47
H17	≤ 4		170	205	140	-	3	2	51
H18	≤ 3		180	-	145	-	3	2	55

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 12 — Alloy EN AW-3103 [Al Mn1]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	95	130	35	-	25	20	29
H14	≤ 40	≤ 10	130	165	110	-	6	4	40
H16	≤ 15	≤ 5	160	195	130	-	4	3	47
H18	≤ 10	≤ 3	180	-	145	-	3	2	55
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		95	130	35	-	25	20	29
H11	≤ 17		105	140	55	-	20	16	32
H12	≤ 15		115	150	75	-	14	12	35
H13	≤ 12		125	160	95	-	11	8	38
H14	≤ 10		130	165	110	-	6	4	40
H15	≤ 7		145	180	120	-	5	4	44
H16	≤ 5		160	195	130	-	4	3	47
H17	≤ 4		170	205	140	-	3	2	51
H18	≤ 3		180	-	145	-	3	2	55

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 13 — Alloy EN AW-5005 [Al Mg1(B)]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	100	145	40	-	18	16	30
H14	≤ 40	≤ 10	140	-	110	-	6	4	45
H18	≤ 15	≤ 2	185	-	155	-	4	2	55
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		100	145	40	-	18	16	30
H14	≤ 5		140	-	110	-	6	4	45
H18	≤ 3		185	-	155	-	4	2	55

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 14 — Alloy EN AW-5005A [Al Mg1(C)]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	100	145	40	-	18	16	30
H14	≤ 40	≤ 10	140	-	110	-	6	4	45
H18	≤ 15	≤ 2	185	-	155	-	4	2	55
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		100	145	40	-	18	16	30
H14	≤ 5		140	-	110	-	6	4	45
H18	≤ 3		185	-	155	-	4	2	55

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 15 — Alloy EN AW-5019 [Al Mg5]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	250	320	110	-	16	14	65
H12, H22, H32	≤ 40	≤ 25	270	350	180	-	8	7	85
H14, H24, H34	≤ 25	≤ 10	300	-	210	-	4	3	95
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		250	320	110	-	16	14	65
H12, H22, H32	≤ 10		270	350	180	-	8	7	85
H14, H24, H34	≤ 5		300	380	220	-	4	3	95
H16, H26, H36	≤ 3		320	-	260		2	2	-

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 16 — Alloy EN AW-5049 [Al Mg2Mn0,8]

Drawn rod/bar Not specified								
Drawn tube								
Temper	Wall thickness t mm	R_m MPa		$R_{p0,2}$ MPa		A % min.	A_{50mm} % min.	*HBW* Typical value
		min.	max.	min.	max.			
O, H111	≤ 20	180	250	80	-	17	15	50
H11	≤ 17	195	260	100	-	13	12	58
H12	≤ 15	210	270	120	-	10	9	65
H13	≤ 12	225	280	140	-	7	6	70
H14	≤ 10	240	290	160	-	4	3	75
H15	≤ 7	250	300	180	-	3	2	80
H16	≤ 5	260	310	200	-	3	2	83
H17	≤ 4	270	320	220	-	2	1	85
H18	≤ 3	280	-	240	-	2	1	-

Table 17 — Alloy EN AW-5251 [Al Mg2Mn0,3]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	150	200	60	-	17	15	45
H14, H24, H34	≤ 30	≤ 5	200	240	160	-	5	4	65
H18, H28, H38	≤ 20	≤ 3	240	-	200	-	2	2	80
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		150	200	60	-	17	15	45
H12, H22, H32	≤ 10		180	220	110	-	5	4	60
H14, H24, H34	≤ 5		200	240	160	-	4	3	65
H16, H26, H36	≤ 5		220	260	180	-	3	2	70
H18, H28, H38	≤ 3		240	-	200	-	2	2	80

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 18 — Alloy EN AW-5052 [Al Mg2,5]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	170	230	65	-	20	17	47
H12, H22, H32	≤ 40	-	210	250	160	-	7	5	60
H14, H24, H34	≤ 25	-	230	270	180	-	5	4	68
H16, H26, H36	≤ 15	-	250	290	200	-	3	3	73
H18, H28, H38	≤ 10	-	270	-	220	-	2	2	77
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		170	230	65	-	20	17	47
H14, H24, H34	≤ 5		230	270	180	-	5	4	68
H18, H28, H38	≤ 5		270	-	220		2	2	77

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 19 — Alloy EN AW-5154A [Al Mg3,5(A)]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	200	260	85	-	16	14	55
H14, H24, H34	≤ 25	-	260	320	200	-	5	4	75
H18, H28, H38	≤ 10	-	310	-	240	-	3	2	80
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		200	260	85	-	16	14	55
H14, H24, H34	≤ 10		260	320	200	-	5	4	75
H18, H28, H38	≤ 5		310	-	240		3	2	80

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 20 — Alloy EN AW-5754 [Al Mg3]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	180	250	80	-	16	14	45
H14, H24, H34	≤ 25	≤ 5	240	290	180	-	4	3	75
H18, H28, H38	≤ 10	≤ 3	280	-	240	-	3	2	88
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		180	250	80	-	16	14	45
H14, H24, H34	≤ 10		240	290	180	-	4	3	75
H18, H28, H38	≤ 3		280	-	240	-	3	2	88

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 21 — Alloy EN AW-5083 [Al Mg4,5Mn0,7]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	270	350	110	-	16	14	70
H12, H22, H32	≤ 30	-	280	-	200	-	6	4	90
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		270	350	110	-	16	14	70
H12, H22, H32	≤ 10		280	-	200	-	6	4	90
H14, H24, H34	≤ 5		300	-	235	-	4	3	100

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 22 — Alloy EN AW-5086 [Al Mg4]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 60	240	320	95	-	16	14	65
H12, H22, H32	≤ 30	-	270	-	190	-	5	4	85
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		240	320	95	-	16	14	65
H12, H22, H32	≤ 10		270	-	190	-	5	4	85
H14, H24, H34	≤ 5		295	-	230	-	3	2	95
H16, H26, H36	≤ 5		320	-	260		2	1	100

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 23 — Alloy EN AW-6012 [Al MgSiPb]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
T4 c	≤ 80	≤ 80	200	-	100	-	10	8	-
T6 c	≤ 80	≤ 80	310	-	260	-	8	6	105
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
T4 c	≤ 20		200	-	100	-	10	8	-
T6 c	≤ 20		310	-	260	-	8	6	105

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

c Properties may be obtained by press quenching.

Table 24 — Alloy EN AW-6026 [Al MgSiBi]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
T6 c	≤ 80	≤ 80	370	-	300	-	8	6	95
T8 c	≤ 80	≤ 60	345	-	315	-	4	3	95
T9 c	≤ 80	≤ 60	360	-	330	-	4	3	95

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

c Properties may be obtained by press quenching.

Table 25 — Alloy EN AW-6060 [Al MgSi]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
T4 [c]	≤ 80	≤ 80	130	-	65	-	15	13	50
T6 [c]	≤ 80	≤ 80	215	-	160	-	12	10	75

Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
T4 [c]	≤ 5		130	-	65	-	12	10	50
	5 < t ≤ 20		130		65		15	13	50
T6 [c]	≤ 20		215	-	160	-	12	10	75

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by press quenching.

Table 26 — Alloy EN AW-6061 [Al Mg1SiCu]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 80	-	150	-	110	16	14	30
T4 c	≤ 80	≤ 80	205	-	110	-	16	14	65
T6 c	≤ 80	≤ 80	290	-	240	-	10	8	95
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		-	150	-	110	16	14	30
T4 c	≤ 20		205	-	110	-	16	14	65
T6 c	≤ 20		290	-	240	-	10	8	95

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

c Properties may be obtained by press quenching.

Table 27 — Alloy EN AW-6262 [Al Mg1SiPb]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
T6 [c]	≤ 80	≤ 80	290	-	240	-	10	8	85
T8 [c]	≤ 50	≤ 50	345	-	315	-	4	3	-
T9 [c]	≤ 50	≤ 50	360	-	330	-	4	3	-
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
T6 [c]	≤ 5 5 < t ≤ 20		290 290	-	240 240	-	10 10	8 8	85 85
T8 [c]	≤ 10		345	-	315	-	4	3	-
T9 [c]	≤ 10		360	-	330	-	4	3	-

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by press quenching.

Table 28 — Alloy EN AW-6262A [Al Mg1SiSn]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
T6 [c]	≤ 120	≤ 85	290	-	240	-	10	8	-
T8 [c]	≤ 120	≤ 85	345	-	315	-	4	3	-
T9 [c]	≤ 120	≤ 85	360	-	330	-	4	3	-
Drawn tube Not specified									

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by press quenching.

Table 29 — Alloy EN AW-6063 [Al Mg0,7Si]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
T4 [c]	≤ 80	≤ 80	150	-	75	-	15	13	50
T6 [c]	≤ 80	≤ 80	220	-	190	-	10	8	75
T66 [c]	≤ 80	≤ 80	230	-	195	-	10	8	80
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		-	155	-	-	20	15	25
T4 [c]	≤ 5		150	-	75	-	12	10	50
	$5 < t \leq 20$		150	-	75	-	15	13	50
T6 [c]	≤ 20		220	-	190	-	10	8	75
T66 [c]	≤ 20		230	-	195	-	10	8	80
T832 [c]	≤ 5		275	-	240	-	5	5	85

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by press quenching.

Table 30 — Alloy EN AW-6063A [Al Mg0,7Si(A)]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 80	-	140	-	-	15	13	25
T4 [c]	≤ 80	≤ 80	150	-	90	-	16	14	50
T6 [c]	≤ 80	≤ 80	230	-	190	-	9	7	75
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		-	140	-	-	15	13	25
T4 [c]	≤ 20		150	-	90	-	16	14	50
T6 [c]	≤ 20		230	-	190	-	9	7	75

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by press quenching.

Table 31 — Alloy EN AW-6064A [Al Mg1SiBi]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
T6 [c]	≤ 80	≤ 80	310	-	260	-	8	6	95
T8 [c]	≤ 80	≤ 60	345	-	315	-	4	3	95
T9 [c]	≤ 80	≤ 60	360	-	330	-	4	3	95
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
			min.	max.	min.	max.	min.	min.	
T6 [c]	≤ 20		310	-	260	-	8	6	100
T8 [c]	≤ 10		345	-	315	-	4	3	105
T9 [c]	≤ 10		360	-	330	-	4	3	110

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by tempering under press.

Table 32 — Alloy EN AW-6065 [Al Mg1Bi1Si]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
T6 [c]	≤ 120	≤ 85	290	-	240	-	10	8	-
T8 [c]	≤ 120	≤ 85	345	-	315	-	4	3	-
T9 [c]	≤ 120	≤ 85	360	-	330	-	4	3	-
Drawn tube Not specified									

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Properties may be obtained by press quenching.

Table 33 — Alloy EN AW-6082 [Al Si1MgMn]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 80	-	160	-	110	15	13	35
T4 c	≤ 80	≤ 80	205	-	110	-	14	12	70
T6 c	≤ 80	≤ 80	310	-	255	-	10	9	95
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
O, H111	≤ 20		-	160	-	110	15	13	35
T4 c	≤ 20		205	-	110	-	14	12	70
T6 c	≤ 5		310	-	255	-	8	7	95
	$5 < t \leq 20$		310	-	240	-	10	9	95

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

c Properties may be obtained by press quenching.

Table 34 — Alloy EN AW-7020 [Al Zn4,5Mg1]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
T6 c	≤ 80	≤ 50	350	-	280	-	10	8	110
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
T6 c	≤ 20		350	-	280	-	10	8	110

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

c Properties may be obtained by press quenching.

Table 35 — Alloy EN AW-7022 [Al Zn5Mg3Cu]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
T6 c	≤ 80	≤ 80	460	-	380	-	8	6	133
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
T6 c	≤ 20		460	-	380	-	8	6	133

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

c Properties may be obtained by press quenching.

Table 36 — Alloy EN AW-7049A [Al Zn8MgCu]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
	D a	S b	min.	max.	min.	max.	min.	min.	
T6	≤ 80	-	590	-	500	-	7	5	170
Drawn tube									
Temper	Wall thickness t mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	*HBW* Typical value
			min.	max.	min.	max.	min.	min.	
T6, T6510,	≤ 5		590	-	530	-	6	4	170
T6511	$5 < t \leq 20$		590	-	530	-	7	5	170

a D = Diameter for round bar.

b S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

Table 37 — Alloy EN AW-7075 [Al Zn5,5MgCu]

Drawn rod/bar									
Temper	Dimensions mm		R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
	D [a]	S [b]	min.	max.	min.	max.	min.	min.	
O, H111	≤ 80	≤ 80	-	275	-	165	10	8	60
T6	≤ 80	≤ 80	540	-	485	-	7	6	150
T651	≤ 80	≤ 80	540	-	485	-	5	4	150
T73 [c]	≤ 80	≤ 80	455	-	385	-	10	8	135
T7351 [c]	≤ 80	≤ 80	455	-	385	-	8	6	135

Drawn tube								
Temper	Wall thickness t mm	R_m MPa		$R_{p0,2}$ MPa		A %	A_{50mm} %	HBW Typical value
		min.	max.	min.	max.	min.	min.	
O, H111	≤ 20	-	275	-	165	10	8	60
T6	≤ 20	540	-	485	-	7	6	150
T6510, T6511	≤ 20	540	-	485	-	5	4	150
T73 [c]	≤ 20	455	-	385	-	10	8	135
T73510 [c], T73511 [c]	≤ 20	455	-	385	-	8	6	135

[a] D = Diameter for round bar.

[b] S = Width across flats for square and hexagonal bar, thickness for rectangular bar.

[c] Reference is made to EN 754-1:2016, 5.7 and Annex B for material in this temper.

Annex A
(informative)

List of tempers used in Tables 1 to 37

Temper	Definition
F	As fabricated (no mechanical property limits specified)
O	annealed - products achieving the required annealed properties after hot forming processes may be designated as O temper
H11	strain-hardened - 1/8 hard
H12	strain-hardened - 1/4 hard
H13	strain-hardened - 3/8 hard
H14	strain-hardened - 1/2 hard
H15	strain-hardened - 5/8 hard
H16	strain-hardened - 3/4 hard
H17	strain-hardened - 7/8 hard
H18	strain-hardened - 4/4 hard (fully hardened)
H111	annealed and slightly strain-hardened (less than H11) during subsequent operations such as stretching or straitening
H22	strain-hardened and partially annealed - 1/4 hard
H24	strain-hardened and partially annealed - 1/2 hard
H26	strain-hardened and partially annealed - 3/4 hard
H28	strain-hardened and partially annealed - 4/4 hard (fully hardened)
H32	strain-hardened and stabilized - 1/4 hard
H34	strain-hardened and stabilized - 1/2 hard
H36	strain-hardened and stabilized - 3/4 hard
H38	strain-hardened and stabilized - 4/4 hard (fully hardened)
T3	solution heat-treated, cold worked and naturally aged
T351	solution heat-treated, stress-relieved by stretching a controlled amount (permanent set 1 %, to 3 %) and naturally aged The products receive no further straightening after stretching.
T3510	solution heat-treated, stress-relieved by stretching a controlled amount (permanent set 0,5 % to 3 % for drawn tube) and naturally aged The products receive no further straightening after stretching.

T3511	same as T3510 except that minor straightening is allowed after stretching to comply with standard tolerances
T4	solution heat-treated and naturally aged
T451	solution heat-treated, stress-relieved by stretching a controlled amount (permanent set 1 % to 3 %) and naturally aged The products receive no further straightening after stretching.
T4510	solution heat-treated, stress-relieved by stretching a controlled amount (permanent set 0,5 % to 3 % for drawn tube) and naturally aged. The products receive no further straightening after stretching.
T4511	same as T4510 except that minor straightening is allowed after stretching to comply with standard tolerances
T6	solution heat-treated and then artificially aged
T651	solution heat-treated, stress-relieved by stretching a controlled amount (permanent set 1 % to 3 %) and then artificially aged. The products receive no further straightening after stretching.
T6510	solution heat-treated, stress-relieved by stretching a controlled amount (permanent set 0,5 % to 3 % for drawn tube) and then artificially aged The products receive no further straightening after stretching.
T6511	same as T6510 except that minor straightening is allowed after stretching to comply with standard tolerances
T66	solution heat-treated and then artificially aged - mechanical property level higher than T6 achieved through special control of the process (6000 series alloys)
T73	solution heat-treated and then artificially overaged in order to achieve the best stress corrosion resistance
T7351	solution heat-treated, stress-relieved by stretching a controlled amount (permanent set 1 % to 3 % and then artificially overaged in order to achieve the best stress corrosion resistance The products receive no further straightening after stretching.
T73510	solution heat-treated, stress-relieved by stretching a controlled amount (permanent set 0,5 % to 3 % and then artificially overaged in order to achieve the best stress corrosion resistance The products receive no further straightening after stretching.
T73511	same as T73510 except that minor straightening is allowed after stretching to comply with standard tolerances
T8	solution heat-treated, cold worked and then artificially aged
T832	solution heat-treated, cold worked a controlled specific amount and then artificially aged (applies to 6063 drawn tube)
T851	solution heat-treated, stress-relieved by stretching a controlled amount (permanent set 1 % to 3 %) and then artificially aged The products receive no further straightening after stretching.
T9	solution heat-treated, artificially aged and then cold worked

Bibliography

[1] EN 515, *Aluminium and aluminium alloys — Wrought products — Temper designations*

[2] EN 573-3, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 3: Chemical composition and form of products*

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit, or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

Storing and using standards

Standards purchased in soft copy format:

- A British Standard purchased in soft copy format is licensed to a sole named user for personal or internal company use only.
- The standard may be stored on more than 1 device provided that it is accessible by the sole named user only and that only 1 copy is accessed at any one time.
- A single paper copy may be printed for personal or internal company use only.

Standards purchased in hard copy format:

- A British Standard purchased in hard copy format is for personal or internal company use only.
- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than 1 copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright & Licensing team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email subscriptions@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Useful Contacts

Customer Services
Tel: +44 345 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 345 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.